International Journal of Botany
and Research (IJBR)
ISSN (P): 2277–4815; ISSN (E): 2319–4456
Vol. 11, Issue 2, Dec 2021, 69–78

TRANS STELLAR
•Journal Publications •Research Consultancy

ESTIMATING WEED ABUNDANCE AND DIVERSITY IN TURMERIC FIELDS OF VISAKHAPATNAM TRIBAL AREA, ANDHRA PRADESH, INDIA

G. R. N. S. SUJATHA[1], K. SATYAVATHI[2], S. B. PADAL[3] & P. SREEVANI[4]

[1,3]*Department of Botany, Dr.V.S. Krishna Govt. Degree College, Visakhapatnam, Andhra Pradesh, India*

[2,4]*Department of Botany, Andhra University, Visakhapatnam, Andhra Pradesh, India*

ABSTRACT

The present study was conducted to investigate weed diversity in turmeric crops fields of Visakhapatnam tribal region, Andhra Pradesh during 2020-2021. Arbitrarily Quadrate strategy was applied for examining the characters of the weed community. Pattern characters of Community like Density, Abundance, Frequency and IVI is determined. The study area was divided into two site-1 Paderu and site-2 Araku. Turmeric is one of the main business zest crops developed all through India. The results of phytosociological studies revealed that A sum of 79 plant species having a place with 68 genera and 29 families were in Site 1 and 70 plant species have a place with 56 genera and 23 families were in site 2 distinguished as turmeric crop land weeds. In both sites, Asteraceae and Euphorbiaceae are driving plant family in turmeric field of Eastern Ghats Visakhapatnam.

KEYWORDS: Abundance, Diversity, Estimating, Turmericweed & Visakhapatnam

Received: Oct 26, 2021; **Accepted**: Nov 16, 2021; **Published**: Nov 30, 2021; **Paper Id**.: IJBRDEC20218

Original Article

INTRODUCTION

The total production of turmeric in the world is estimated to be about 1, 60,000 tonnes, of that Asian country only accounts for 78 per cent (Anon 1999). In India over an area of 1, 40,000 hector turmeric cultivation withan account of 6, 00,000 tons per hectare.Weed abundance and diversity got to be intensively studied as key elements of each multifariousness conservation within agro ecosystems (Rassam *et al* 2011, Marshall et al 2003; Gibson et al 2006) and included weed management of agro ecosystem (Smith *et al* 2010, Travlos2013, Maxwell and O'Donovan 2007).In most agroecosytem annual species common in ancient tillage agricultural system (Streit et al 2003), while perennial weeds square measure favored with the help of the absence of disturbance (Buhler 1995). Different parameters, inclusive of phytosociology and reciprocal relations of weeds in crops have to be compelled to be studied as completely as possible. Turmeric is a prolonged length crop. Behind schedule emergence, slow initial increase of the crop and sufficient land area to be had due to wider spacing allow extra sunlight to attain the soil resulting in conducive surroundings for speedy weed growth and vast damage to crop yield (Sathiyavani & Prabhakaran 2015). The major weeds of the agricultural field were *Echinochloa colona, Digitaria sanguinalis, Panicum dichotomiflorum, Commelina benghalensis, Cyperus iria,Ageratum*species, *Physalis minima, Bidens pilosa* and *Aeschynomene indica* (Rana *et.al* 2017).Crop management powerfully impacts the abundance and variety of weeds (Nichols *et al* 2015). The structure and composition of flora within the agricultural fields were compared in terms of density, frequency, abundance and their relative values used for estimating of weeds (Curtis 1959). The objective of the present study on the distribution of various weed species in turmeric crop fields of the two study sites in the districts of Visakhapatnam is an important investigation and has an applied significance in

effective weed management and crop yield improvement.

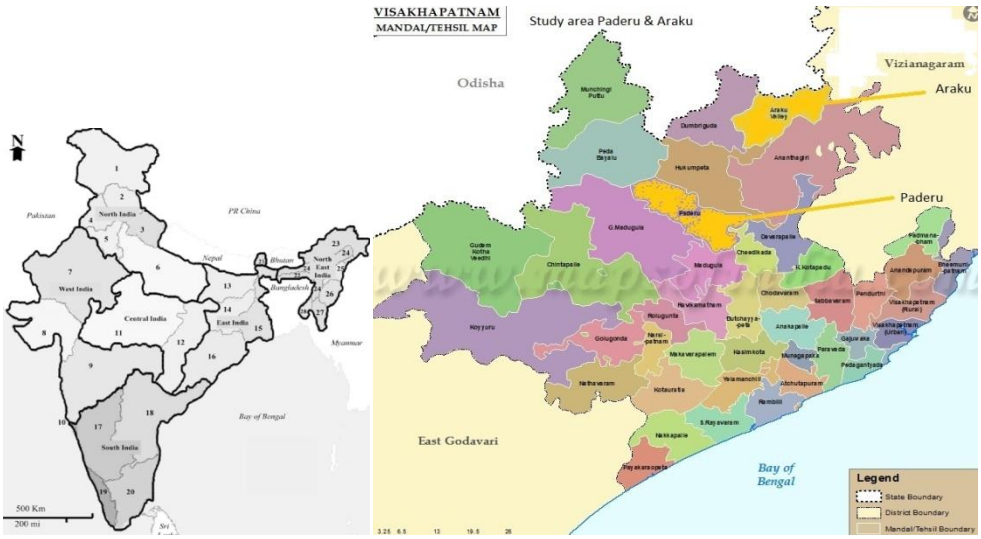
MATERIAL AND METHOD

Study Area

Visakhapatnam district is one of the largest districts in Northern Andhra Pradesh with a total area of 13,460 Sq. Km. The coordinate of this district islies between 170 121 to 830 331 N latitudes and 820181 to 830221 E longitudes. On the Northern side it borders with Srikakulam district, in the North West side Orissa, the Bay of Bengal in the East and South and East Godavari District in the South West. The present study area was divided into two sites Site one is Paderu and site-2 is Araku. The developed turmeric fields of the area are plagued with countless weeds making substantial misfortunes in crop yield. The District receives annual normal rainfall of 1202 mm. of which south – west monsoon accounts for 66.2% of the normal while North – East monsoon contributes 33.5% of the normal rainfall during 2005-2006. The rest is shared by summer showers and winter rains.

Field Study

The exploration of the area under study includes the planned field trips to a number of locations for estimating turmeric crop weed collection. It used to be carried out during 2020-2021. The random sampling method used to be adopted for this study to note down the presence of weed species in turmeric crop fields. Several field trips have been made to cover the interior villages of the study sites of Visakhapatnam turmeric cultivated tribal area.



Methodology

The phytosociological characters: Frequency, Density and Abundanceand their relative values and importance value index (IVI) are calculated (Misra 1968, Curtis and Mclntosh 1950, Mueller- Dombois and Ellenberg1974). The following are the different formulas for estimation of the weed abundance in turmeric field:

$$\text{Density} = \frac{\text{Sum of density of a species}}{\text{Total number of quadrates studied}}$$

$$\textbf{Frequency (\%)} = \frac{\text{Number of quadrates in which the species occurred}}{\text{Total number of quadrates studied}} \times 100$$

$$\textbf{Abundance} = \frac{\text{Sum of abundance of a species}}{\text{Total number of quadrates in which the species occurred}}$$

$$\textbf{Relative density} = \frac{\text{Density of a species}}{\text{Sum total of densities of all the specie}} \times 100$$

$$\textbf{Relative frequency} = \frac{\text{Frequency of a species}}{\text{Sum of frequency of all the specie}} \times 100$$

$$\textbf{Relative abundance} = \frac{\text{Abundance of a species}}{\text{Sum total of abundance of all the species}} \times 100$$

Importance Value Index

The relative importance of a species in the community is expressed in terms of Dominance. The characters like frequency, density, basal area or cover cannot give a clear picture of the relative position of a species. Curtis and McIntosh 1950 proposed the term Importance Value Index (IVI) for the sum total of the relative values ((relative frequency, relative density, relative abundance) of the three quantitative characters

Shannon-Weiner Index (1963) is used for measuring species diversity. Shannon-wiener index (H) = - S [Pi (ln Pi)] Here Pi = (Sum of character of one weed species/Total variety of all individual of weed species) × 100. Evenness index (Pielou 1977). Evenness index (E) = H/ Log S Here H = Shannon diversity index S = Number of species. Species Richness: Species richness is any other mode of expression of the range and is primarily based on the whole range of species and the whole range of individuals in a pattern or habitat.

Identification of Specimens

After finishing the weed collection from the crop fields the specimens had been recognized by way of evaluating with the certified specimens at the Andhra University Herbarium. Later these identifications had been checked once more with the regional Herbarium with the assist of floras, monographs and different applicable literature. Each plant used to be significantly studied and recognized the use of the Flora of British India (Hooker, 1872-1897), Flora of Presidency of Madras (Gamble, 1915-1936). Flora of Andhra Pradesh (Pullaiah and Chennaiah 1997) and district floras of Srikakulam (Rao and Hara Sriramualu, 1986) and Visakhapatnam (Subba Rao and Kumari, 2002). Vizianagaram (Venkaiah, 2004).

RESULTS AND DISCUSSIONS

In the present study in Site 1 Paderu turmeric cultivated place have been recorded a total of 79 weed species belonging to 68 genera and 29 families and 70 species belonging to 55 Genera and 23 families have been recorded in Site 2 Araku. (Table .1). In Site 1 amongst the 29 families one species each these are Acanthaceae, Aizoaceae, Asclepiadaceae, Chenopodiaceae, Commelinaceae, Cucurbitaceae, Mimosaceae, Papaveraceae Passifloraceae, Poaceae and Polygonaceae. Asteraceae is the dominant family representing with 13 species, Euphorbiaceae had the second position with 10 species accompanied by Amaranthaceae with 7, Malvaceae with 6 species. In site 2, amongst the 29 families one species each these are Acanthaceae, Asclepiadaceae, Boraginaceae, Commelinaceae, Papaveraceae and Passifloraceae. In site 2 Euphorbiaceae is the dominant family representing with 13 species, Asteraceae occupies the second position with 11 species accompanied by Poaceae with 6, Amaranthaceae and Malvaceae with 5 species. These families are also common in different agricultural crops, as in sunflower (Adegas *et al* 2010) and in sugarcane fields (Oliveira and Freitas 2008).

Fig.2 Site 1

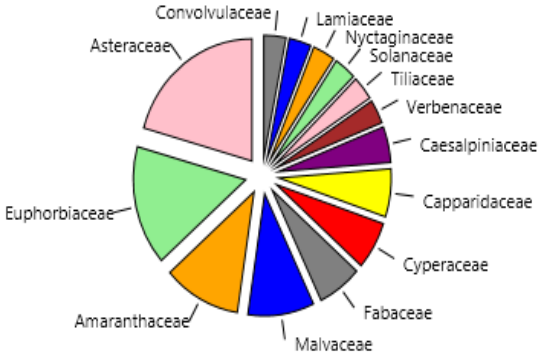
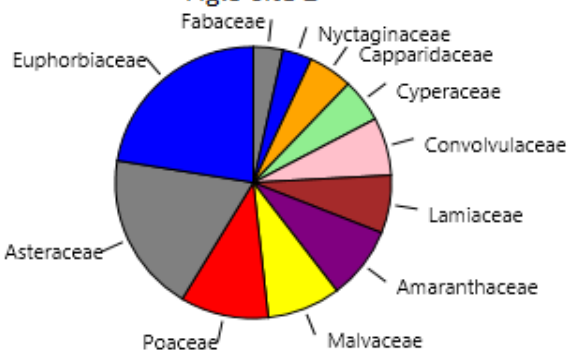


Fig.3 Site 2



The information pertaining top ten dominated weeds in Site 1 and Site 2 their frequency, density, abundance and their relative values for finding out the distribution pattern and Importance Value Index (IVI) of the weeds obtainedin Turmeric crop fields are presented in Table –2 and 3. In Site 1 and 2 a total of 79 and 70 species had been recorded each Site from 50 quadrates. The most frequent weed species in Site -1 are *Imperata cylyndrica* (L.) Raeusch., *Cynodon dactylon* (L.) Pers., *Parthenium hysterophorus* L., *Bidens pilosa* L. and *Phyllanthus amarus* Schum. & Thonn have been observed to be the most considerable species accompanied by *Chromolaena odorata* (3.0), *Celosia argentea* (2.6), *Phyllanthus amarus* (2.6) and *Cyperus iria* (2.58) in that order. The top ten Important Value Index (IVI) of individuals weed species in Site -1 have been encountered in the turmeric crop fields revealed that *Cynodon dactylon* (L.) Pers. (7.808) was the most important species accompanied by *Bidens pilosa* L. (6.641), *Ageratum conyzoides* L. (6.476), *and Dactyloctenium aegyptium* (L.) Willd (6.349) and *Chloris barbata* (L.) Sw. (6.313) (Fig 2) in Site -2, *Bidens pilosa* L. (10.768), observed by *Parthenium hysterophorus* L. (10.542), *Cynodon dactylon* (L.) Pers (10.096) and *Phyllanthus amarus* Schum. &Thonn.(7.382) that order (Table-1&2). Earlier employees reported *Cyperus rotundus* used to be the most important species in sugarcane crops and *Marsilea quadrifolia* was the most important weed species in rice crops of the Visakhapatnam district (Nagaraju *et al* 2014). It is used to be found that the predominance of some species confirmed an excessive value of significance in the phytosociological context due to the fact of their remarkable phenotypic adaptability. Plant diversity indexes are mathematical expressions that combine three aspects of community structure, species diversity, reciprocal index and Simpson diversity index. The plant range research of the turmeric discipline in Paderu and Araku is claimed to be Shannon-wiener Index of Site 1 is 4.268, Simpson index is 0.9835 and Evenness index is 0.8203 and

Shannon-wiener Index of Site 2 is 4.02, Simpson index is 0.978 and Evenness index is 0.796.

A thorough perusal of literature pertaining to different weed floras of different areas of Andhra Pradesh and India. In Rayalaseema region 508 weed species have been mentioned by (Lakshmaiah 2006) which consists of 89 weed species in all dry crops and 46 in groundnut crop in Agrestals of the Rayalaseema region. (Pullaiah 1997) pronounced a complete of 715 weed species in Andhra Pradesh state. The available literature on Andhra Pradesh State suggests that the existing quantitative analysis corroborates with previous workers findings. Phytosociological study conducted by Prayaga Murthy (2012) in two major crops, suggested 56 and 78 weed species from rice and sugarcane fields respectively. Phytosociological research by Kumar *et al* (2013) in the sugarcane crop fields of Srikakulam district indicated that Parthenium hystophorus used to be the most universal and necessary weed species.

Table 1: Family wise Aabundance of weed Species in Both Sites (1&2)

	Site-1			Site- 2	
S. No	**Family**	**No .species**	**S.No**	**Family**	**No .species**
1	Acanthaceae	1	1	Acanthaceae	1
2	Aizoaceae	1	2	Amaranthaceae	5
3	Amaranthaceae	7	3	Asclepiadaceae	1
4	Asclepiadaceae	1	4	Asteraceae	11
5	Asteraceae	13	5	Boraginaceae	1
6	Boraginaceae	2	6	Capparidaceae	3
7	Caesalpiniaceae	3	7	Commelinaceae	1
8	Capparidaceae	4	8	Convolvulaceae	4
9	Chenopodiaceae	1	9	Cuscutaceae	1
10	Commelinaceae	1	10	Cyperaceae	3
11	Convolvulaceae	2	11	Euphorbiaceae	13
12	Cucurbitaceae	1	12	Fabaceae	2
13	Cyperaceae	4	13	Lamiaceae	4
14	Euphorbiaceae	10	14	Malvaceae	5
15	Fabaceae	4	15	Nyctaginaceae	2
16	Lamiaceae	2	16	Papaveraceae	1
17	Malvaceae	6	17	Passifloraceae	1
18	Mimosaceae	1	18	Poaceae	6
19	Mulluginaceae	1	19	Portulacaceae	1
20	Nyctaginaceae	2	20	Scropulariaceae	1
21	Papaveraceae	1	21	Tiliaceae	1
22	Passifloraceae	1	22	Verbenaceae	1
23	Poaceae	1	23	Zygophyllaceae	1
24	Polygonaceae	1		Total	70
25	Portulacaceae	1			
26	Scropulariaceae	1			
27	Solanaceae	2			
28	Tiliaceae	2			
29	Verbenaceae	2			
	Total	**79**			

Table 2: Top Ten Dominated weeds in Site -1

Name of the Plant	F	D	A	RF	RD	RA	IVI
Trianthema portulacastrum L.	68	4.420	6.500	2.000	2.659	1.512	6.171
Ageratum conyzoides L.	80	4.620	5.775	2.353	2.779	1.344	6.476
Bidens pilosa L.	88	4.680	5.318	2.588	2.815	1.237	6.641
Parthenium hysterophorus L.	90	4.620	5.133	2.647	2.779	1.194	6.621
Synedrella nodiflora (L.) Gaertn.	72	4.220	5.861	2.118	2.539	1.364	6.020

Phyllanthus amarus Schum. & Thonn.	84	4.260	5.071	2.471	2.563	1.180	6.213
Chloris barbata (L.) Sw.	44	4.440	10.091	1.294	2.671	2.348	6.313
Cynodon dactylon (L.) Pers.	90	6.000	6.667	2.647	3.609	1.551	7.808
Dactyloctenium aegyptium (L.) Willd.	66	4.620	7.000	1.941	2.779	1.629	6.349
Imperata cylyndrica (L.) Raeusch.	92	4.260	4.630	2.706	2.563	1.077	6.346

Table 3. Top Ten dDominated weeds in Turmeric Field in Site- 2

Name of the Species	F	D	A	RF	RD	RA	IVI
Amaranthus spinosus L.	68	2.460	3.618	3.363	2.425	1.070	6.857
Bidens pilosa L.	86	4.900	5.698	4.253	4.829	1.685	10.768
Blainvillea acmella (L.f.) Philipson	46	2.860	6.217	2.275	2.819	1.839	6.932
Parthenium hysterophorus L.	72	5.000	6.944	3.561	4.928	2.054	10.542
Synedrella nodiflora (L.) Gaertn.	34	2.680	7.882	1.682	2.641	2.331	6.654
Commelina benghalensis L.	52	2.680	5.154	2.572	2.641	1.524	6.737
Cyperus pilosus Valh,	48	3.340	6.958	2.374	3.292	2.058	7.723
Phyllanthus amarus Schum. & Thonn.	38	3.120	8.211	1.879	3.075	2.428	7.382
Cynodon dactylon (L.) Pers	72	4.680	6.500	3.561	4.613	1.922	10.096
Imperata cylyndrica (L.) Raeusch.	50	4.220	8.440	2.473	4.159	2.496	9.128

CONCLUSIONS

This is the first attempt of Phytosociology work in Turmeric crop field. This Study offers us the most needed information about Distributation of Weed community. It provides us a baseline records about Weed. This end result is beneficial for Weed management and in addition lookup in financial value, Medicinal value and different branches associated with weed, this statistic is beneficial for Farmers, Researchers and different fascinated people. The presence of some weeds in two or three vegetation suggests their wider adoptability whilst limit of some weeds to precise crop indicates their requirement for one-of-a-kind circumstance in order to grow. This survey will furnish a base for future weed surveys. The weed plant life work at the regional level would be of accurate supply of records on technical and taxonomic data.

ACKNOWLEDGMENTS

The authors are highly thankful to farmers and native people of the study area for cooperation during the survey period and for sharing valuable information about useful weed species with us.

REFERENCES

1. *Adegas, FS. Oliveira, MF. Vieira, OV. Prete, CEC. Gazziero, DLP. Voll, E. 2010. Levantamento fitossociológico de plantas daninhas na cultura do girassol. Planta Daninha* ***28(4):*** *705-716.*
2. *Buhler, D. D. 1995. Influence of tillage systems on weed population dynamics and management in corn and soybean in the central USA. Crop Sci. 35, 1247–1258.*
3. *Curtis JT. 1959. The vegetation of Wisconsin; an ordination of plant community. University of Winconsin press, Madison.*
4. *Gamble, JS. and Fischer, CEC. 1915-35. Flora of the Presidency of Madras. London (Reprinted edition 1957, Calcutta).*
5. *Gibson, R., Nelson, I., Hopkins, G., Hamlett, B., and Memmott, J.2006. Pollinator webs, plant communities and the conservation of rare plants: arable weeds as a case study. J. Appl. Ecol. 43, 246–257.*
6. *Hooker, JD. 1872-1897. The Flora of British India. Vols 1-7 (Indian Reprinted. 1973). Bishen Singh Mahendra Pal Singh, Dehra Dun, India.*

7. *Kumar, R.T., B.T. Reddy & P.P. Murty. 2013. Weed distribution in Sugarcane fields of Srikakulam district, A.P., India. Research Journal of Pharmaceutical, Biological and Chemical Sciences 4(1): 1380-1389.*
8. *Lakshmiah, K. 2006. Agrestals of Rayalaseema region, Andhra Pradesh. Ph.D. Thesis, S.K.D University, Anantapur, Andhra Pradesh.*
9. *Marshall, E., Brown, V., Boatman, N., Lutman, P., Squire, G., and Ward, L. 2003. The role of weeds in supporting biological diversity within crop fields. Weed Res. 43, 77–89.*
10. *Maxwell, B., and O'Donovan, J. 2007. Understanding weed–crop interactions to manage weed problems. Non-Chemical Weed Management: Principles, Concepts and Technology. Oxfordshire: CAB International, 17–33.*
11. *Misra, R. 1968. Ecology WorkBook. Oxford and IBH Publishing Company, Calcutta.*
12. *Murty, P. P. and Venkaiah, M. 2012. Phytosociological attributes of weed flora in major crops of North Coastal Andhra Pradesh, India. Pak. J. Weed Sci. Res. 18:107-126.*
13. *Mueller-Dombois, D., And H. Ellenberg. 1974. Aims and methods of vegetation ecology. Wiley and Sons, New York. 547 pp*
14. *Nichols, V., Verhulst, N., Cox, R., and Govaerts, B.2015. Weed dynamics and conservation agriculture principles: a review. Field Crops Res. 183, 56–68.*
15. *Oliveira AR, Freitas SP.2008. Levantamento fitossociológico de plantas daninhas em áreas de produção de cana-de-açúcar. Planta Daninha.**26(1):**33-46.*
16. *Philips EA. 1959.Methods of vegetation study. Henry Holt and company, New York.*
17. *Pielou EC. 1977. Mathematical Ecology. A Wiley interscience publication, New York. 364-75.*
18. *Power, A. G. 2010. Ecosystem services and agriculture: tradeoffs and synergies. Philos. Trans. R. Soc. B Biol. Sci. 365, 2959–2971.*
19. *Pullaiah, T. and Chennaiah, E. 1997. Flora of Andhra Pradesh, India. Vol I. Scientific Publishers, Jodhpur.*
20. *Rassam, G., Latifi, N., Soltani, A., and Kamkar, B. 2011. Impact of crop management on weed species diversity and community composition of winter wheat fields in Iran. Weed Biol. Manag. 11, 83–90.*
21. *Rao, RS. and Hara Sriramulu, S. 1986. The Flora of Srikakulam district, Andhra Pradesh, India. Meerut.*
22. *Sathiyavani, E.Prabhakaran, NK. 2015a.. Effect of integrated weed management practices on plant height, number of tillers in turmeric during kharif season. International Journal of Horticulture. 5(2):1-8*
23. *S.S. Rana, Neelam Sharma, D. Badiyala and Rajinder Kumar. 2017. Weed management in turmeric. Indian Journal of Weed Science 49(1): 51–57.*
24. *Shannon, C. E. and Weaver, W. 1963. The Mathematical Theory of Communication. Urbana, IL: University of Illinois Press.*
25. *Smith, R. G., Mortensen, D. A., and Ryan, M. 2010. A new hypothesis for the functional role of diversity in mediating resource pools and weed–crop competition in agro ecosystems. Weed Res. 50, 37–48.*
26. *Streit, B., Rieger, S., Stamp, P., and Richner, W. (2003. Weed populations in winter wheat as affected by crop sequence, intensity of tillage and time of herbicide application in a cool and humid climate. Weed Res. 43, 20–32.*
27. *Subba Rao, GV. and Kumari, GR. 2002**.** Flora of Visakhapatnam District, Andhra Prades, (Botanical Survey of India, Kolkata)*

28. *Travlos, I. S. 2013. Competition between ACCase-inhibitor resistant and susceptible sterile wild oat (Avena sterilis) Biotypes. Weed Sci. 61, 26–31.*

29. *Venkaiah, M. 2004. Studies on the vegetation and flora of Vizianagaram district, Andhra Pradesh, India. (Andhra University, Visakhapatnam).*

30. *Krishnamoorthy, C., K. Soorianathasundaram, and S. Mekala. "Effect of fertigation on FUE, quality and economics of cultivation in turmeric (Curcuma longa L.) cv. BSR 2." International Journal of Agricultural Science and Research (IJASR) 5.1 (2015): 67-72.*

31. *Basak, D. E. B. O. J. I. T., and Jagadish Chandra Jana. "Performances on growth and rhizome sizes of turmeric (Curcuma longa L.) Varieties, grown under conventional and organic nutrient management practices under terai region of west Bengal." International Journal of Agricultural, 6 (2), 257 262 (2016).*

32. *Viswavidyalaya, Mohanpur. "Performance of Turmeric (Curcuma Longa L) VaritiesIn Gangetic Alluvial Plains of West Bengal." International Journal of Agricultural Science and Research (IJASR) 7.4 (2017): 241-244.*

33. *Rajalakshmi, J., et al. "Morphological and molecular characterization of Pythium aphanidermatum the incitant of rhizome rot in turmeric." Int. J. Env. Ecol. Family and Urban Studies 6.4 (2016): 1-8.*

34. *Devanand, I., and M. Kamala. "Indigenous traditional knowledge on crop protection practices." International Journal of Agricultural Science and Research 7.5 (2017): 345-352.*

Common Weeds in Turmeric field

1.*Oxalis corniculata* L. 2. *Amaranthus viridus* L. 3. *Solanum torvum* SW. 4. *Parthenium hysterophorus* L.5. *Mimosa pudica* L.6. *Triumfetta rhomboidea* Jacq. 7. *Lantana camara* L. 8. *Bi dens pilosa* L.9. *Phyllanthus amarus* Schum. & Thonn. 10. *Crotalaria laburnifolia* L. 11. *Malvastrum coromandelianum* (L.) Garcke. 12. *Euphorbia heterophylla* L.